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Patent Application of

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for

TIITLE: "ASSET MANAGEMENT OF LIVESTOCK IN AN OPEN RANGE USING SATELLITE COMMUNICATIONS"

CROSS-REFERENCE TO RELATED APPLICATIONS:	Not Applicable
FEDERALLY SPONSORED RESEARCH:	Not Applicable
SEQUENCE LISTING OR PROGRAM:	Not Applicable

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to livestock management in an open range, corral, or feedlot and more particularly to the method and system for livestock data collection via a relay satellite and the distribution of information gathered over a public network.

BACKGROUND OF THE INVENTION

[0002] Currently, there are a few livestock electronic monitoring systems. Generally they use passive radio tags and active readers although some have active transmitter designs for a confined area. None of these systems offers the capability of livestock monitoring in an open rang along with a globally networked accessible database.

[0003] This invention relates to a method and system that enables a livestock producer to monitor and collect data from the livestock in an open range, pasture, corral, or feedlot and to update monitored data into a global Internet accessible information base. By using this system any animal may be tracked from its conception to its consumption virtually anywhere on earth, and its history can provide source verification, quality assurance, and performance tracking.

[0004] Although it is possible to automate the identification and provide data entry at a localized level, many of those involved in the livestock production and processing cycles are not equipped with the technology necessary for automation. The primary objective of this invention is to provide an automated animal identification method and system for those non-automated entities and persons involved in the production and processing of livestock with informational records readily available via a public network such as the Internet. The present invention allows those persons and entities to identify livestock animals with electronic identification units, which are in the form of a radio

frequency transponder reader within an active electronic identification radio frequency identification ear tag that communicates by satellite, to enter and collect information on that individual animal automatically and provide this information to the livestock owner from asset management over a public network. The present invention also allows for compatibility with existing livestock identification technologies so that these devices can continue to be used either independently or integrated within this data collection system.

[0005] Currently, many non-automated persons or entities do not have electronic identification transponder readers, nor do they generally have data collection software. An object of the present invention is to provide an effective automated data collection and database management methodology in the livestock industry including effective communication and sharing of data between those involved in the production, processing cycle, and regulation. One result of this data collection and management invention is that quality assurance and data source verification for individual animals will be available throughout the production cycle and universally available to multiple individuals and / or organizations via private and public network access devices. The source verification provides an opportunity for enhanced product value through improved quality assurance, food safety, and to automatically generate reports that meet the Country Of Origin Labeling (COOL) that will be mandatory after Sept. 30, 2004 according to the U.S. Department of Agriculture.

[0006] Another object of this data collection and management invention is that animal-specific performance information can be provided to the producer, the stockman, the feedlot, the packer, the buyer, and government agencies simultaneously so that those entities can make informed herd management and operational decisions. Improved information availability permits all segments of the livestock industry to reduce their cost of operations while improving product quality. The opportunities for process improvement field from avoiding duplicate vaccination treatments, rapid detection and treatment of a sick animal, selecting more cost effective breeding stock; selecting more cost effective feeds and to prevent overgrazing of pasture and range areas.

[0007] As part of the production process, other entities, which are not usually in the direct chain of title to an animal, also have an interest in a portion of the data. Veterinarians can access or update the health history, nutritionists can access the feed and health history, and bankers can determine the location of their collateral. An object of the present invention is to employ authorization levels settable by the livestock owner to designate what information may be made available to these entities.

[0008] Through the current invention, the complete history of an animal can be available throughout the production and processing cycle, and both source verification and specific performance information are accessible to multiple interested parties.

[0009] Although the invention is described in the context of beef cattle, it is not so limited. It should be apparent to those skilled in the art that the invention can be modified, without departing from its principles, for other forms of livestock.

DESCRIPTION OF THE PRIOR ART:

[0010] Electronic identification devices and systems have provided a good method for providing localized identification of livestock. Typically, electronic identification systems use a passive electronic identification device that is induced to transmit its identification signal by an externally radiating source.

[0011] The passive electronic identification devices may be a transponder carried with the individual animal on a collar as illustrated and described in Carroll U.S. Pat. No. 4,475,481, issued Oct. 9, 1984, entitled "Identification System" and in Kuzara U.S. Pat. No. 4,463,353, issued Jul. 31, 1984, entitled "Animal Feeding and Monitoring System"; in an ear tag such as those commercially available from Destron/Fearing, Inc., Allflex USA, Inc. and Avid Marketing, Inc.; in a transponder implanted in the animal as illustrated and described in Pollack U.S. Pat. No. 4,854,328, issued Aug. 8, 1989, entitled "Animal Monitoring Telltale and Information System" and in Hanton U.S. Pat. No. 4,262,632, issued Apr. 21, 1981, entitled "Electronic Livestock Identification System"; or in a bolus such as illustrated and described in U.S. Pat. No. 4,262,632, issued Apr. 21, 1981, entitled "Electronic livestock identification system" by John P. Hanton and Harley A. Leach; a multitude patents U.S. Pat. Nos. 5,673,647, 6,000,361,

6,135,055, 6,318,289, add 6,516,746, issued over several years to Pratt, entitled "Cattle Management Method and System"

[0012] Although electronic identification through radio frequency identification (RFID) tags or barcodes are used in some phases of the livestock production cycle, all of these devices are designed to operate with the livestock in a confined location such as a coral or feedlot. There is a need to provide a means for automated individual animal identification in an open range and throughout the production cycle in order to maximize the capability of source verification and minimize the difficulty of data entry and data retrieval as well as making the information easily available to multiple individuals or groups throughout the industry.

[0013] At different stages of the production cycle, there are different databases, which exist for different business purposes. The livestock producer will typically maintain his own database, a stockman will have an inventory system, a feedlot will have a management database, and a packer will have its own inventory and management system. There is a trend toward larger marketing alliance and national databases that include some data from each of these industry segments.

[0014] U.S. Pat. No. 5,322,034, which issued Jun. 21, 1994 to Richard L. Willham, for a "Livestock record system" describes a method for storing the individual animal's identification and performance data on a programmable electronic identification and data storage module carried with the animal. An object of the present invention is to provide a low-cost per animal system for obtaining and maintaining

source verification and performance databases that are independent of the animal and available to multiple individuals or groups not just those with access to the "data storage carried with the animal".

[0015] U.S. Pat. No. 5,315,505 issued to William C. Pratt on May 24, 1994 for a "Method and system for providing animal health histories and tracking inventory of drugs" describes a method and system for providing improved drug treatment to selected animals in a retained group. A computer system is used to provide an operator with the health and drug treatment history of an animal. With this information and a diagnosis of the animal's health condition, a drug treatment is chosen. The diagnosis and treatment are entered into the computer system to update the animal's health and treatment history. An object of the present invention is to provide complete source verification and performance databases for all key livestock events including current biometric data as well as historical biometric data collected.

[0016] U.S. Pat. No. 5,673,647 for a "Cattle management method and system", issued on Oct. 7, 1997 to William C. Pratt, describes an automated method and system for providing individual animal electronic identification, measurement and value-based management of cattle in a large cattle feedlot. That method includes individual animal identification, a computer system, and multiple measurements coupled with cattle handling and sorting system. An object of the Pratt patent was to build a feedlot database to more accurately identify and measure characteristics such as weight, so that subsequent animals could be produced and fed for more effective value-based

selection and management of the animals. In particular, that database related to calculations for economic management of feeding and shipping to permit optimum weight gains and feedlot ship dates. Whereas the feedlot patent disclosed identifying a particular animal on arrival at the feedlot, an object of the present invention is to not limit the data collection to a feedlot, but track and collect data individual animals on an open range, corral, or feed lot throughout the entire production and processing cycle.

BACKGROUND OF THE INVENTION -Objects and Advantages

[0017] Accordingly, besides the objects and advantages of the open rang monitoring described in my above patent, several additional objects and advantages of the invention are:

a) to provide an automated daily record of the location of any animal being monitored allowing energy savings as a result of known location when that animal needs to be manually serviced;
b) to provide a complete printable record of the animal location during it's entire life cycle meeting the Country of Origin (COOL) requirements;
c) to provide an electronic tag that can poll an injected Radio Frequency Identification Device (RFID) and transmit that information to a satellite;
d) to provide a tag radio transmitter / radio frequency identification device (RFID) reader that has a battery or fuel cell as a power source;
e) to provide a tag that has a solar charger when the ear tag is battery powered;

f) to provide a tag that is powered from an external microwave source while near source, such as hand held RFID reader or chute side RFID reader;

g) to provide a tag with a re-usable electronic module that can be removed from the outer tag casing and inserted in a new tag casing to lower the cost of the system.

[0019] Further objects and advantages of the open range livestock asset management system are to provide automatic notification to the livestock owner if the animal is outside a predefined range, or biometric range set by the livestock owner. An automated information collection system that does not require the livestock owner to continuously manually record data, while providing historical individual animal data to stake holders not in the direct title chain. The additional capability of providing the livestock owner relevant information of rangeland capacities and alarm in an over grazing condition. Still further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

SUMMARY OF THE INVENTION

[0020] In accordance with the present invention a method that enables a livestock producer to monitor their livestock in an open range, to automatically collect individual animal data via a relay satellite link and to update that data into a globally assessable format over a public communications network. By using this system any animal may be tracked from its conception to its consumption, and its history will provide source verification, quality assurance, and performance tracking to multiple concerned individuals or groups that are allowed access to the data. The system is not

limited to monitoring livestock in a corral or feedlot and does not require the livestock owner to invest in electronic infrastructure to take advantage of the system.

[0021] The primary objective of this invention is to provide an automated animal identification method and asset management system for those non-automated entities and persons involved in the production and processing of livestock that is available via a public network. The present invention allows those persons and entities to identify livestock animals with electronic identification units in the form of a radio frequency transponder reader contained within an active electronic identification radio frequency identification tag that collects information on that individual animal and communicate that information by a relay satellite to a hub collection and processing server for redistribution the information via a public network.

[0022] Another objective of the present invention allows for compatibility with existing livestock identification technologies so that these devices can continue to be used either independently or integrated within this information collection system.

[0023] An additional objective of the system is to provide automated monitoring of range and pastureland to prevent overgrazing conditions that lower the quality of the livestock and value of the range and pastureland for future grazing potential.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] For a more complete understanding of the present invention and for further advantages thereof, reference is now made to the following description of the Preferred Embodiments taken in conjunction with the accompanying drawing in Figure 1 is an Overall System Block Diagram of the present invention of Satellite Livestock Monitoring in an Open Range. This figure shows the components of the system including the electronic ear tag, relay satellite, communications hub, network connections, and network data entry and display devices.

[0025] Figure 2 shows the preferred embodiment of the electronic module with the different electronic subsystems of the electronic tag device.

[0026] Figures 3 presents the tag external features and the location the tag as attached to the animal, as well as the radio frequency identification device (RFID) being implanted in the animal or being contained in the ear tag device itself.

[0027] Figure 4 illustrates a typical data entry form where individual animal information may be added to the information collected automatically by the livestock owner using a personal computer with Internet connectivity.

[0028] Figure 5 represents a graphical image such as would be available to the livestock owner while utilizing a standard communication network interface display such as a Web browser, showing the location of an animal along with its unique identification number and biometric data.

[0029] Figures 6 A to D illustrates various aspects of the electronic livestock satellite radio tag with a removable internal electronic module and how the internal

electronic module can be inserted into a new tag casing and later removed for re-utilization.

DRAWINGS — Reference Numerals

10 network connections (Internet)
12 relay satellite
14 electronic ear tag
16 satellite communication hub and network access
18 personal computer
20 personal data unit (PDA)
22 cellular phone
24 radio frequency identification device (RFID)
26 satellite transmitter / receiver
28 global positioning receiver (GPS)
30 solar collection panel
32 battery
34 externally excited power sensor / source
36 memory and central processor unit
38 radio frequency identification device reader
40 ear tag external casing
42 ear tag fastener
44 ear tag electronics module
46 visual identification number
50 solar panel
52 embedded satellite antenna
54 solar panel to electronic module connector
56 satellite antenna to electronic module connector
58 unsealed end of new ear tag
60 graphical representation of range
62 latitude and longitude of animal
64 current range food capacity indicator
66 scale of graphic representation
68 identification and biometric representation of a single animal
70 warning message box
71 Typical electronic data entry form

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0030] With reference to the drawing in Figure 1 the Overall Block Diagram form of the electronic identification tag system. The electronic radio frequency identification device (RFID) reader 38 within the electronic module of the animal tag **14** polls the radio frequency identification device (RFID) **24** for unique identification number and current biometric data information **40** and stores the information in the processing unit **36** of the animal tag **14** along with the current location and time received from the GPS

receiver **28**. The animal tag **14** satellite transmitter **26** then transmits the animals unique identification number, location, biometrics and time information last stored to the satellite **12** which relays that information to the network hub **16.** The network hub collects the information and stores it in an electronic record on a data server. Software at the hub automatically saves the electronic record to the associated livestock owner's records and appends those electronic records with the updated information. The updated electronic data records are then made available to a public network **10** for access by the livestock owner or other stakeholders via personal computers **18**, cell phones **22**, or personal data units **20** with network access capabilities and rights. All data records from the network hub **16** will be available via a Web browser or other network graphic user interface form to users that are connected to the network and have access rights to the data.

[0031] Figure 2 shows the basic components of the removable electronic module and that it contains the satellite transmitter **26,** the global positioning satellite receiver (GPS) **28, a** data processing central processor unit (CPU) and memory subsystem **36**, external radio frequency field sensing power source **34**, and the radio frequency identification device (RFID) reader **38,** which may be any type of radio frequency reader, but for reasons given herein, this invention is particularly useful for passive RFID devices that may be implanted under the skin of the livestock animal. The electronic module **44** is supplied with operating power by electrical power by electrical power supply **32,** or the external radio frequency field sensing power source **34**. The

electrical supply system will be in one form that can be recharged during daylight by a solar power source **30.** The system conserves battery power by only reading the RFID device **24** and the GPS receiver **26** data periodically or when triggered by an event such a pre-programmed clock time or from the satellite transmitter **26** when polled.

[0032] In Figure 3 according to this invention a Global Positioning (GPS) Receiver **28** is integrated into the electronic identification tag system. The GPS **28** collects information such as latitude, longitude, and time, which is stored in the CPU / memory and data processing unit **36.** The information data is combined with other data collected from the RFID **24** and transmitted to the satellite when triggered by a request from the satellite or at a time scheduled by the CPU **36**. The GPS **28** receiver will also provide a high stability reference source that is utilized by the transmitter **26** to maintain a highly stable frequency that allows for higher reliability of the communications link with the satellite **12**.

[0033] According to this invention a set of biometric sensors **40** are integrated into the RFID **24**. The biometric detectors collect data such as heart rate, temperature, and blood pressure periodically and that information is stored in the memory location **36** when the RFID **24** device is polled by the RFID reader **38**. The biometric information may be of any type that may be available. The RFID device is available from several sources and device functions and capabilities are expected to change in the future. The

CPU **36** will easily be re-programmed for features as they are added by the RFID **24** manufactures.

[0034] Figure 4 illustrates the preferred form of the invention with the identification tag indicating visually a unique identification number **46** that is electronically linked to a specific electronic data record and unique identification number of the RFID **24.** The RFID chip **24** is shown in Figure 4 as being optionally mounted in the external tag casing **40** or implanted under the livestock animals' skin. Either method will work with this invention, but the preferred method is that the RFID device **24** is implanted since this method is more tamper resistant and can stay with the animal for its entire production cycle with a low possibility of being removed from the animal by accident. The actual method utilized may be determined by the livestock owners' preference.

[0035] Figure 5 illustrates a typical GUI interface that the livestock owner will use to locate specific information about an individual animal. The livestock owner would access a map of his location **60** and request that all animals being tracked within the selected group are displayed **64**. By entering a specific individual animal or group of individual animals the graphic user interface would update and highlight information specific to those animals. The livestock owner would then select one of the highlighted animals and open the current detailed data record for that animal **68**. All historical data

such as sex, lineage, vaccinations, and feeding records as well as current records for location and biometric data will be easily accessed.

[0036] The livestock owner can choose to manually modify the data record of the individual animal or group of animals by updating the database record with new information such as new feed type or recent vaccinations. The electronic data record is verified and then updated at the network hub server. The updated information would also be available over the network to other individuals or groups that may have an interest and as well as the access rights to that animal or group of animal records.

[0037] With reference to Figure 2A to 2D the electronic satellite transmitter receiver / RFID reader animal tag **14** consists of a lightweight plastic outer shell **40**, removal electronic module **44**, and solar collector **50**. Figure 2A illustrates a new tag shell **40** and electronic module **44** prior to the electronic module **44** being inserted into the tag casing **40**. This figure also indicates the solar collector connector **54** and the satellite antenna connector **56** on the electronic module. Figure 2B shows a completed ear tag **14** with end sealed **48** and ready to be attached to a herd animal. Figure 2C shows the tag casing **40** with the end cut off for access to the electronic module **44**. Figure 2D shows the empty used electronic tag casing **40** and the electronic module **44** removed and ready to be reused in a new tag casing not shown. All figures 2A to 2 D illustrate the solar collector **50** and the embedded satellite antenna **52**.